

Ike's storm surge an extreme danger to Texas

Posted by: [JeffMasters](#), 4:51 PM EDT on September 11, 2008

[Hurricane Ike](#) remains a huge a dangerous Category 2 hurricane, and has changed little since this morning. Ike's central pressure continues to hold steady at 950 mb, as measured by the Hurricane Hunters at 3:14 pm EDT. Ike's tiny 9-mile wide eye appears to be collapsing, which will allow a new eyewall of much larger-diameter to form. This event should allow Ike to start intensifying tonight. The latest [Tropical Cyclone Heat Potential](#) image shows that the center of Ike has just finished crossing a cold eddy in the Gulf of Mexico waters, and is now beginning to pass along the north side of a warm eddy. This change in oceanic heat should also help allow Ike to intensify tonight. The eddy is not ideally positioned, though, for rapid intensification to occur. The eddy is on the left (weak) side of the hurricane, where wind speeds are slower since the forward motion of the storm subtracts from the wind speed of the circulation. These lower-speed winds will be able to evaporate less moisture from the warm ocean than if the eddy were positioned on Ike's right side. Oceanic heat content remains moderately high after Ike crosses the eddy, which should allow some modest strengthening to continue. Wind shear of 10-15 knots and dry air on Ike's west side is hampering Ike slightly, as evidenced by the lack of upper-level outflow on the storm's west side and lack of heavy thunderstorm activity. Shear is expected to decrease to 5 knots by the time of landfall Saturday morning, and I expect Ike will be maintaining its strength or slowly intensifying right up until landfall. Ike will probably be at the top end of Category 2 strength at landfall, with 110 mph winds.

Comparisons to Carla and Katrina

Ike is larger than Katrina was, both in its radius of tropical storm force winds—275 miles—and in its radius of hurricane force winds—115 miles. For comparison, Katrina's tropical storm and hurricane force winds extended out 230 and 105 miles, respectively. Ike's surge will probably rival the massive storm surge of [Hurricane Carla](#) of 1961. Carla was a Category 4 hurricane with 145 mph winds at landfall, and drove a 10 foot or higher storm surge to a 180-mile stretch of Texas coast. A maximum storm surge of 22 feet was recorded at Port Lavaca, Texas. Despite the fact that the center of Carla hit over 120 miles southwest of Houston, the hurricane drove a 15-foot storm surge into the bays along the south side of the city. Ike's maximum surge is not likely to reach the extreme values above 20 feet seen in Hurricane Carla, though.



Figure 1. Experimental storm surge heights for Ike. There is a 10% chance the storm surge from Ike will exceed these values. Data courtesy of NOAA.

The total energy of Ike

The amount of water Ike has put in motion is about 10% greater than what Katrina did, and thus we can expect Ike's storm surge damage will be similar to or greater than Katrina's. The way we can estimate this damage potential is to compute the total energy of Ike's surface winds (kinetic energy). To do this, we must look at how strong the winds are, and factor in the areal coverage of these winds. Thus, we compute the Integrated Kinetic Energy (IKE) by squaring the velocity of the wind and summing over all regions of the hurricane with tropical storm force winds or higher. This "Integrated Kinetic Energy" was [recently proposed](#) by Dr. Mark Powell of NOAA's Hurricane Research Division as a better measure of the destructive power of a hurricane's storm surge than the usual Category 1-5 Saffir-Simpson scale. For example, Hurricane Katrina hit Mississippi as a strong Category 3 hurricane, yet its storm surge was more characteristic of a Category 5 storm. Dr. Powell came up with a new scale to rate potential storm surge damage based on IKE (not to be confused with Hurricane Ike!) The new scale ranges from 1-6. Katrina and Wilma at their peaks both earned a 5.1 on this scale (Figure 2). At 12:30pm EDT today, [Ike earned a 5.2 on this scale](#), the second highest kinetic energy of any Atlantic storm in the past 40 years. Hurricane Isabel of 2003 had the highest. Note that the figures I quoted in this morning's blog saying Ike had an IKE of 180, 50% higher than Katrina's, were found to be in error due to some bad data from one of the Hurricane Hunter observations (the IKE is an experimental product, after all). Thus, this morning's IKE was actually a little lower than Katrina's.

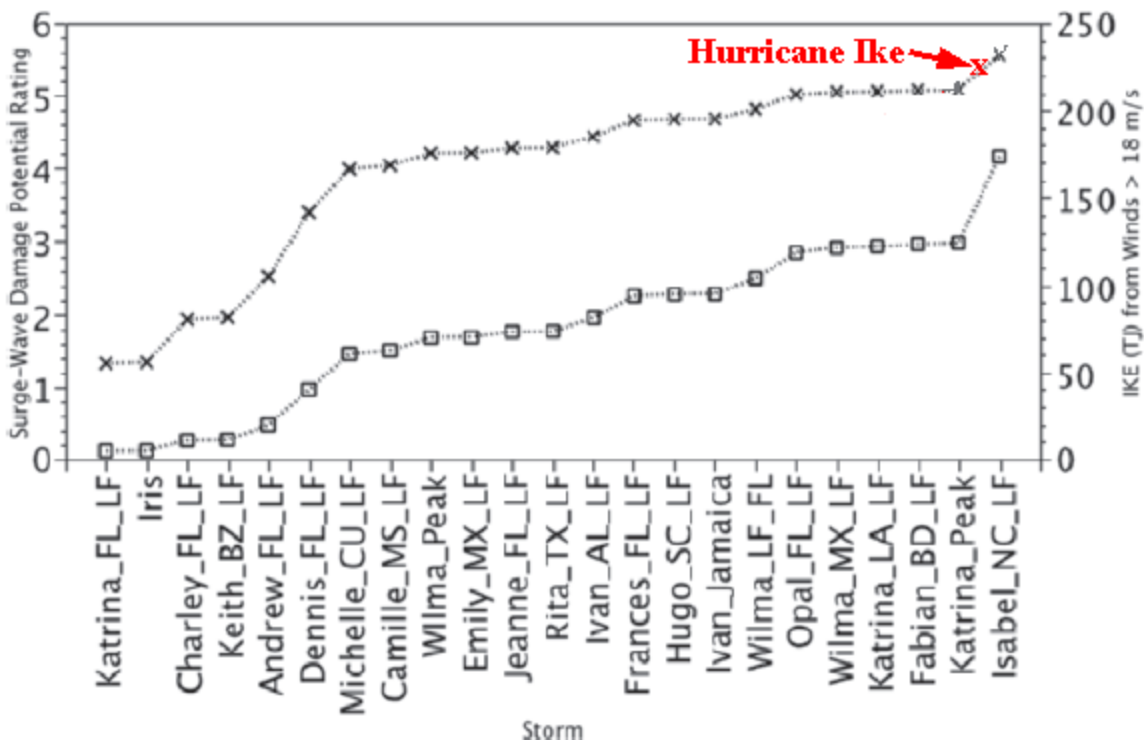


Figure 2. Comparison of the potential damage from storm surge and waves on a scale of 1 to 6 (left scale, and corresponding to little "x" marks on the plot), as a function of total Integrated Kinetic Energy in Tera-joules (IKE, on the right scale, corresponding to the little squares on the plot). Hurricane Ike at 12:30pm EDT had an IKE of 134, 10% higher than the value of 122 Katrina had at landfall in Mississippi. Ike's amount of wind energy can generate storm surge and wave damage rated at 5.2 on a scale of 1 to 6, worse than Katrina's 5.1 at landfall. Image credit: "[Tropical Cyclone Destructive Potential by Integrated Kinetic Energy](#)" by Mark Powell and Timothy Reinhold.

Ike's waves

All this energy is also going into the waves in the Gulf of Mexico, and the offshore oil rigs can expect to receive a terrific battering. At 1:50pm CDT, waves at the [buoy 42001](#) 180nm south of Louisiana peaked at 30 feet. NHC [is predicting](#) Ike's waves will peak at 50 feet (15 meters) in the northern Gulf on Friday. For comparison, Hurricane Ivan of 2004 generated 27 meter (89 foot) high waves in the Gulf of Mexico. The oil companies spent hundreds of millions of dollars upgrading their oil rigs in the Gulf in the wake of the destruction wrought by Ivan and Katrina and Rita, and I'm not anticipating severe damage to the rigs from Ike's 50-foot waves.

Ike's storm surge

According to the [NOAA tide gauges](#), the storm tides along the Mississippi coast have peaked at 4 feet above normal, and are currently running 5 feet above normal on the east side of New Orleans at Shell Beach in Lake Borgne. A storm surge of 5.9 feet was observed in New Orleans' Industrial Canal at 10:45 am CDT, and 5.75 feet in Waveland, Mississippi. [Coastal Alabama](#) is reporting a 4-6 foot storm surge, with 10-15 foot waves. Considering the center of Ike is over 250 miles south of these locations, it is not hard to imagine that Texas will get a 15-20 foot storm surge, even if Ike does not strengthen.

Ike will probably inundate a 250-mile stretch of Texas coast from Port O'Connor to the Louisiana border with a 10-15 foot storm surge. This will occur even if Ike is a Category 1 storm at landfall. If Ike is a Category 3+ hurricane at landfall, surges of 20+ feet are possible. The latest experimental storm surge forecast from NOAA's SLOSH model (Figure 1) shows a 10% chance that Ike's storm surge will exceed 18-21 feet at Galveston. The Galveston sea wall is 17 feet high, so it may get overtopped. At noon today, a mandatory evacuation of the entire island was ordered in case this worst-case scenario is realized. The official NHC forecast is calling for maximum storm surge heights of 20 feet.

What should Texas residents do?

We must assume Ike will intensify to a Category 3 hurricane by landfall, which would likely do \$20-\$30 billion in damage. Ike's storm surge is going to be affect a huge area and be tremendously destructive. The latest [Hurricane Local Statement from the Galveston National Weather Service office](#) puts things in pretty stark perspective:

All neighborhoods... and possibly entire coastal communities... will be inundated during high tide. Persons not heeding evacuation orders in single family one or two story homes will face certain death. Many residences of average construction directly on the coast will be destroyed. Widespread and devastating personal property damage is likely

elsewhere. Vehicles left behind will likely be swept away. Numerous roads will be swamped... some may be washed away by the water. Entire flood prone coastal communities will be cutoff. Water levels may exceed 9 feet for more than a mile inland. Coastal residents in multi-story facilities risk being cutoff. Conditions will be worsened by battering waves. Such waves will exacerbate property damage... with massive destruction of homes... including those of block construction. Damage from beach erosion could take years to repair.

I recommend Texas residents consult NHC's [wind probability product](#) to determine their odds of getting hurricane force winds.

For storm surge evacuation zone information, consult the [Texas Division of Emergency Management](#).

For storm surge heights, consult our [Storm surge risk for the Texas coast](#) page.

Links to follow

[Galveston, TX weather](#)

[Tide gauges along the Gulf Coast](#)

[Mid Gulf Buoy 180 nm South of Southwest Pass, LA \(42001\)](#)

Tropical disturbance 91L north of Puerto Rico

An area of disturbed weather ([91L](#)) has developed a few hundred miles north of Puerto Rico. [Satellite loops](#) show that 91L has a very small amount of heavy thunderstorm activity, but does have a circulation at middle levels of the atmosphere. A surface circulation is not apparent, but the mid-level spin could work its way down to the surface over the next day or two. The disturbance is under about [20 knots of wind shear](#), and is also having trouble with some dry air to the west. Shear is expected to remain 10-20 knots through Saturday, then increase to 25 knots. We may expect some slow development until Saturday, when wind shear should be too high to allow further development. None of the models are developing 91L. By Tuesday, as 91L will be approaching the east coast of Florida, shear is expected to decline to 15 knots, and some additional development may be possible, if the disturbance holds together that long.

I'll have an update tonight if there's a significant change in Ike.

Jeff Masters

Reader Comments



3501. [palmpointbiloxi](#) 3:19 PM GMT on September 12, 2008

Share this link with anyone you love in the Hurricane Ike affected areas! Watch the video... read the editorial!

[Link](#)



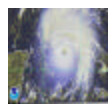
3502. [Giga2001](#) 3:19 PM GMT on September 12, 2008

This may be a silly question, but I am utterly confused as to why the storm surge maps show a higher storm surge the further inland you go. Can anyone explain that one?



3503. [HuHunter](#) 3:19 PM GMT on September 12, 2008

They think he will stay a cat 2, so I think you guys up there are very 'lucky' or do you disagree with me?



3505. [Cotillion](#) 3:20 PM GMT on September 12, 2008

Ike seems to have one purpose in mind.

To wipe Galveston off the map.



3506. [HTownJitters](#) 3:20 PM GMT on September 12, 2008

3451 LAGal—great info, thanks|



3507. [clwmark](#) 3:21 PM GMT on September 12, 2008

Quoting listenerVT:

Posted this awhile ago, but never saw it show up:

*Deaths in Texas will not be on the heads of Jim Cantore or Doc Lyons.
They are doing a great job explaining and showing the imminent devastation.
Cantore even said that the people and local authorities do not seem to be taking Ike seriously enough.
It is unconscionable that 50% of the people in Galveston did not evacuate!!*

It's like the old saying you cant help someone that doesn't want to help themselves. They just showed a live news interview from Galv. and the reported said a car just went by with what looked to be a family with young children in it. Unbelievable



3508. [airChrist](#) 3:21 PM GMT on September 12, 2008

Quoting Chiggy007:

Anybody here expect rapid deepening to 940 mb in the next 12 hours! THIS is a moot point now since effects of IKE are going to be like a CAT4/5 BUT I see def see a wide eye forming and once that forms I think all bets are off...but what do I know!! :)

Avila disagrees - [NHC F'cast Discussion](#)

[But it does look like it's wrapping](#)



3509. [snotly](#) 3:21 PM GMT on September 12, 2008

Quoting StPeteRich:

Huraldo Revera is reporting from the Galveston Wall

Oh, that's ok. I was worried it might be someone else...

jk



3510. [Vooter](#) 3:22 PM GMT on September 12, 2008

Water's already up to the rooftops in Surfside Beach, TX....

<http://www.chron.com/disp/story.mpl/front/5997512.html>



3511. [JeffM](#) 3:22 PM GMT on September 12, 2008

Quoting TRed:

just got word that chuck norris is on his way to galveston to "ask" everyone to evacuate

"please"

No. He is on his way to Galveston to make Ike turn around and head back to Africa.

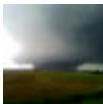


3512. [Patrap](#) 3:22 PM GMT on September 12, 2008

As a former USMC Air Winger.

I can assure you that the USMC New River Squadrons from the MCAS there can move a whole Lotta Floks by Helo Extraction ..fast.

Pray we dont see the New River Jacksonville CH-46's and CH-53's Deploy to Texas.



3513. [MichaelSTL](#) 3:22 PM GMT on September 12, 2008

Quoting Cotillion:

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To wipe Galveston off the map.

I find things like this particularly scary (CNN):

Galveston spokeswoman Mary Jo Naschke estimated Friday morning that **just over half of the city's 58,000 people had been evacuated.**

Considering that this is already happening:



3514. [seztiger](#) 3:26 PM GMT on September 12, 2008

Quoting GulfScotsman:

save my fellow man from certain death - by all means neceissary.

3515. [StormJunkie](#) 3:27 PM GMT on September 12, 2008

[KHOU feed](#)



3516. [Zaphod](#) 3:27 PM GMT on September 12, 2008

Ike's eye appears to be clearing. IF this is indeed an eye, and not just a disruption, the winds will have a good chance of catching the pressure.

With the pressure and presentation, 100kt is a given. 120kt is reasonable, and higher is possible unless dry air or other corruption occurs again. Things are not looking good for less than a solid Cat 3 IMHO, with a Cat 4/5 surge.

If the roads from Galveston are still open, everybody had best be on them.

So far the surge numbers are coming in even higher than projected. I wonder how many people that were told to hunker down will be swimming before dawn tomorrow? I feel pity for those who were told to evac but didn't. I feel sorrow for those who are told to hunker down and do.



3517. [LSU9501](#) 3:27 PM GMT on September 12, 2008

We took a direct hit from Rita here in Lake Charles and the water is higher now than at the peak of Rita. We live on the river and the water is rising very fast. I wish I knew how to post a pic of this.



3518. [listenerVT](#) 3:27 PM GMT on September 12, 2008

Quoting clwmark:

It's like the old saying you cant help someone that doesn't want to help themselves. They just showed a live news interview from Galv. and the reported said a car just went by with what looked to be a family with young children in it. Unbelievable

Speaking as a person who had irresponsible parents, that oughtta be illegal.



3519. [cajunstorm](#) 3:27 PM GMT on September 12, 2008

anyone see that white spot on the latest rainbow loop. Is that for real?



3520. [pearlandtexas](#) 3:28 PM GMT on September 12, 2008

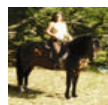
Quoting Giga2001:

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the backs of the bays are like funnels. The water being pushed through the bays has to go somewhere. As it is constricted it has no place to go but up.

As a side note, I appreciate all the political bs posts this morning. All the poofing is like a video game and keeping my mind off of Ike headed for my driveway.

I haven't been through an eye since Alicia. Looking like it might be eye#2 tonight.



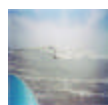
3521. [Skyepony](#) 3:28 PM GMT on September 12, 2008

[The surge](#) is beginning to come over the wall & people are thinking twice about staying.



3522. [texan238](#) 3:28 PM GMT on September 12, 2008

Local forecast for Corpus 20 -30 mile an hour winds. Doesnt that seem a little on the low side?.. Also is there a better way to view this blog without having to refresh the page every few seconds to update the posts?



3523. [Nolehead](#) 3:32 PM GMT on September 12, 2008

3519. [cajunstorm](#) 10:27 AM CDT on September 12, 2008
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yep seen it also...like's turning into 1 hell of a monster!



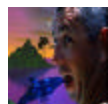
3524. [StormW](#) 3:32 PM GMT on September 12, 2008

What's up with the blog and WU email?



3525. [Vero1](#) 3:33 PM GMT on September 12, 2008

New Bloogggggg!

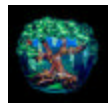


3526. [WindynEYW](#) 3:33 PM GMT on September 12, 2008

Quoting texan238:

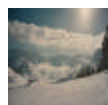
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IF YOU ARE USING FIREFOX AS YOUR BROWSER THERE IS A PLU GIN CALLED REFRESHEVERY THAT YOU CAN DOWNLOAD & SET THE AUTO REFRESH TIMING



3527. [midgulfmom](#) 3:34 PM GMT on September 12, 2008

Mornin' Ya'll. Hard to say Good. This is totally disturbing to my, esp. as a mom to know that there are kids on that island. I am prayin hard for them. MichaelSTL, that picture did it. Oh my, this is hard....



3528. [Starwoman](#) 3:34 PM GMT on September 12, 2008

New Blog up!



3529. [jamnkats](#) 3:34 PM GMT on September 12, 2008

Quoting Nolehead:

3519. [cajunstorm](#) 10:27 AM CDT on September 12, 2008
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yep seen it also...Ike's turning into 1 hell of a monster!

I saw it but thought it had to be a problem with my monitor...



3530. [SeVaSurfer](#) 3:35 PM GMT on September 12, 2008

GOOD LUCK FROM THE EAST COAST HERE FOR ALL THAT REMAIN IN GALV TX! WE ARE AMERICANS AND PATRIOTS! YOU WILL NOT BE LEFT BEHIND TO CLEAN UP THE MESS ALONE. GOD BLESS AND REMEMBER THE ALAMO!!

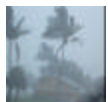


3531. [kingy](#) 3:36 PM GMT on September 12, 2008

Quoting Skyepony:

[The surge](#) is beginning to come over the wall & people are thinking twice about staying.

fox news were saying folk may try to evac only to find the road ahead flooded. Now could be too late



3532. [tropics21](#) 3:36 PM GMT on September 12, 2008

Quoting LakeEffectSnowBand:

Seawall certainly not getting overtopped now but design is meant to dissipate waves upward, so web-vid-cam shows spray going up and over.

[The Spot Restaurant video webcam Galveston](#)

~ Mike G

yes but when the surge comes in that sea wall will probably be under water



3533. [Zaphod](#) 3:37 PM GMT on September 12, 2008

You can now see higher tops on visible now. The highest towers are still on the east, but even the W has a healthy wrap.

TWC says Surfside is flooded but evacuated. High tide tomorrow will be very bad.

Parents who keep kids on Galveston should be arrested for child endangerment.



3534. [LAgal78](#) 3:41 PM GMT on September 12, 2008

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TWC says Surfside is flooded but evacuated. High tide tomorrow will be very bad.

Parents who keep kids on Galveston should be arrested for child endangerment.

As a parent myself, I absolutely cannot understand it. Even if you have no concern for your own life, you should care enough to get your children out of harm's way. Period.



3535. [redavni](#) 3:42 PM GMT on September 12, 2008

Quoting texan238:

Also is there a better way to view this blog without having to refresh the page every few seconds to update the posts?

There is an extension for Firefox that will automatically refresh a page on a set interval, and Opera has it built in. I've used them both and they work. I didn't have any luck with a quick search for an IE solution though.



3536. [FLdewey](#) 3:42 PM GMT on September 12, 2008

D'oh... the Coasties don't have enough helicopters to go around it seems.

--- from the Houston Chronicle ---

A Cypriot freighter loaded with industrial coke is wallowing helplessly in growing seas today after losing power about 90 miles southeast of Galveston as Hurricane Ike continues its approach, the Coast Guard reported.

Coast Guard officials said there is little they can do to rescue the ship's 22 crewmembers and the vessel simply will have to ride out the storm.



3537. [jaevortex](#) 3:43 PM GMT on September 12, 2008

Quoting presslord:

gather your fish together and place them in a plastic bag on ice...you may need to eat them before this is over...

ROFLMAO!!! =>) OH MAN I know i shouldn't be laughing but presslord that was the funniest thing I've read all morning!



3538. [LAgal78](#) 3:44 PM GMT on September 12, 2008

I keep thinking about that vessel out there with the 22 people onboard...visions of the movie Titanic flashing in my head...water coming up and nowhere to run. Absolutely horrible. I hope they are okay :(



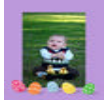
3539. [marinetech47](#) 3:44 PM GMT on September 12, 2008

Quoting LAgal78:

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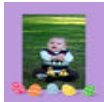
Not ALL people should be parents.

3540. [InsuranceMan](#) 3:46 PM GMT on September 12, 2008



3541. [HopquickSteve](#) 4:01 PM GMT on September 12, 2008

All water turned off in Galveston.



3542. [HopquickSteve](#) 4:05 PM GMT on September 12, 2008

Quoting HuHunter:

They think he will stay a cat 2, so I think you guys up there are very 'lucky' or do you disagree with me?

That's why the I.K.E. needs to replace Saffir Simpson. I appreciate your expertise and all, but inundation is already happening with 12' swells and 6' surge already all over the Texas coast. No one is 'lucky'.

Kyrie Eleison.



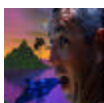
3543. [MahFL](#) 4:29 PM GMT on September 12, 2008

This picture about wraps it up. Earlier there was a lot of grass, now pretty much all water.



3544. [bjdsrq](#) 4:57 PM GMT on September 12, 2008

CNN.com has online live video feeds. Right now their showing video from one of Mark Suddath's boxes.



3545. [WindynEYW](#) 5:11 PM GMT on September 12, 2008

wow!

3546. [NickThompson](#) 5:21 PM GMT on September 12, 2008

Hi!

I asked that question a few nights ago and only one person had an answer and an incomplete one at that. I have been doing research since and here is a metaphor to work with. Think of the waves as a line of waiters carrying glasses of water. As they approach the coast, the rising surface under their feet "trips" them, and they fall forward. Each successive "waiter" spills water on the water spilled by the waiter ahead so the water gets piled on top of the water, all moving forward at a speed faster than the forward motion of the original waves (just as you move forward faster when you "trip").

In short, if you start out with, say, 50 foot waves, each 25 feet above mean sea level, you end up, but the time you get inshore, with a mound of water 18 feet above mean sea level flooding on to the shore.

I think that means you trade wave action for surge. So, the surge will be lower at Galveston, but the wave action much worse. AT the head of the bay (seabrook, say) the wave action will be much less, but the surge much higher.

That's the best I can do after two days trying to figure it out. I am no expert but the experts are pretty much silent on this blog.

Nick Thompson

Quoting Giga2001:

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